It's in the Bag

Reporting Category Probability and Statistics
Topic Making predictions and determining the probability of outcomes

Materials

- Paper bags
- Colored tiles
- It's in the Bag activity sheet (attached)

Vocabulary

data, theoretical probability, experimental probability, sample space, experiment, outcome, prediction, chance, more/less/equally likely

Student/Teacher Actions (what students and teachers should be doing to facilitate learning)

1. Begin the lesson with a discussion of probability. Ask the class, "What is probability?" Lead them to the definition, "The chance of an event occurring." Have students brainstorm terms related to probability and their meanings, including *chance, data, more/less/equally likely, sample space, outcomes,* and *prediction*. Ask students to find partners and, using the Think-Pair-Share strategy, brainstorm a list of situations that involve probability. List these ideas on the board.
2. From the list of probability situations, choose one. For this situation, generate a sample space, or all the possible outcomes, using data from the class. For example, a sample space could be derived from the following situation: "If I put all of the students' names into a hat, what is the probability I would draw a girl's name*?* A boy's name?" The sample space, or possible outcomes, is "boy's name" and "girl's name." Discuss the probability of each (the total number of boys' names out of the total number in the class, and the total number of girls' names out of the total number in the class). Emphasize that the chance of an event occurring can range from 0 (impossible) to 1 (certain).
3. Have students conduct a probability experiment. Give each pair of students a paper bag with 10 color tiles inside (7 blue and 3 red). Explain to the class that they will be predicting, after examining the results of the experiment, how many blue and how many red tiles are inside the bags. Students will take turns pulling out a tile from the bag without looking inside the bag, record its color on the It's in the Bag activity sheet (attached), and then return each tile to the bag. The pairs should continue with this process until they have pulled all 10 tiles from the bag. As the pairs finish, they are to record their results (number of blue and number of red tiles pulled) on a class graph at the front of the room.
4. After the class data have been compiled, have the pairs of students look at the total number of blue and red tiles pulled and make an educated guess about the number of blue and red tiles there are in the bags. When everyone has predicted, discuss the predictions

and their reasons. Ask students, “Why did you decide on ___ blue and ___ red tiles? Who agrees? Who predicted something different? Why? Is that prediction reasonable?”

5. After all are satisfied with their predictions, have the pairs look in the bags and record the actual number of each colored tile. Discuss why their predictions may have differed from the actual number. What was helpful in making their predictions?
6. Repeat the same experiment, but this time use bags with three colors of tiles in different amounts. Discuss the differences.

Assessment

- **Questions**
  - What is probability? Explain in your own words.
  - If you flipped a coin 100 times, and recorded the number of times it landed heads, what would you expect to find? Explain why.
- **Journal/Writing Prompts**
  - Describe a situation that involves probability. Define the sample space, and identify the chances of each outcome.
  - Explain some ways you can decide whether a game or experiment is fair.
- **Other**
  - Provide students with various spinners. Have them construct the sample space of possible outcomes and conduct experiments with the spinners to determine experimental probability. Students can compare the theoretical probability (expected outcomes) to the experimental probability (their results from the experiment).
  - Have students explain why probability chances range from 0 (impossible) to 1 (certain), as well as in between. Have students give examples of events that have a probability of 0, 1, and in between.

Extensions and Connections (for all students)

- Have students put a specified number of tiles of each color in the bag and tell the probability of drawing each color. Have them draw 10 tiles and discuss how close their actual result was to the expected result. Compile class data on the experiment. Was this data closer to the expected outcome? Why?
- **Two Dice Toss.** Have each student write the numbers 1–12 down the left side of a piece of paper. Instruct students to roll two dice, find the sum, and record it for a specified number of times (20–30). Students can then discuss the results. Have students construct a sample space to show all of the possible outcomes for the two dice and determine why some sums are more likely to occur than others.
- **What’s the Problem?** Show students a collection of twelve or fewer objects, some of which are the same. Have students write probability problem statements based on the probability of choosing a particular object out of a box. Students can share their statements with the rest of the class.
- Have students create their own lesson to share with small groups of third or fourth graders. Have students develop a lesson plan as well as an activity sheet with a probability situation. Use a rubric to grade students on their performance.

- Have students determine the theoretical probability of getting rocks, paper, or scissors. Have students play the game 30 times with partners and record the experimental probability and compare results.
- Draw a number line on the board that starts with 0 and goes to 1. Label a few points on the line. Above the 0, write “impossible.” Above the 1, write “certain.” Give students strips of paper with situations on them. (You will see a dinosaur as you walk home today. It will get dark tonight. It will rain tomorrow.) Have them read their paper to the class and then place it where they feel it should go on the number line. Include situations that will fall at different locations on the line.
- Put students in pairs. Give each pair a sheet with boxes labeled 1–12. Give each student 12 counting chips (use a different color for each partner) and have them place their chips anywhere on the board without guidance from the teacher. They can place more than one chip on a number. Tell them they will be rolling two number cubes and removing chips from the game board. For example, if a student roles a seven, he/she removes one chip from the seven box. Have students play until someone wins by removing all his/her chips, or until no one can win. Then discuss the probability of getting each number. Let them then use this knowledge to play the game again.

It’s in the Bag

Name _____ **Date** _____

Blue										
Red										

My prediction:

There are _____ blue tiles in the bag.
There are _____ red tiles in the bag.

Actual results:

There are _____ blue tiles in the bag.
There are _____ red tiles in the bag.

Try again with three colors.

Blue										
Red										
Yellow										

My prediction:

There are _____ blue tiles in the bag.
There are _____ red tiles in the bag.
There are _____ yellow tiles in the bag.

Actual results:

There are _____ blue tiles in the bag.
There are _____ red tiles in the bag.
There are _____ yellow tiles in the bag.